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History, politics and vulnerability: explaining excess mortality in Scotland and Glasgow

Keywords: 'Scottish effect', 'Glasgow effect', 'excess mortality', vulnerability

Word count: 4,083

Abstract

Objectives

High levels of *excess* mortality (i.e. that not explained by deprivation) have been observed for Scotland compared to England & Wales, and especially for Glasgow in comparison with similar post-industrial cities such as Liverpool and Manchester. Many potential explanations have been suggested. Based on an assessment of these, the aim was to develop an understanding of the most likely underlying causes.

Note that this paper distils a larger research report, with the aim of reaching wider audiences beyond Scotland, as the important lessons learned are relevant to other populations.

Study design

Review and dialectical synthesis of evidence

Methods

40 hypotheses were examined, including those identified from a systematic review. The relevance of each was assessed by means of Bradford Hill's criteria for causality alongside – for hypotheses deemed causally linked to mortality – comparisons of exposures between Glasgow and Liverpool/Manchester, and between Scotland and the rest of Great Britain. Where gaps in the evidence base were identified, new research was undertaken. Causal chains of relevant hypotheses were created, each tested in terms of its ability to explain the many different aspects of excess mortality. The models were further tested with key informants from public health and other disciplines.

Results

In Glasgow's case, the city was made *more vulnerable* to important socio-economic (deprivation, deindustrialisation) and political (detrimental economic and social policies) exposures, resulting in

worse outcomes. This vulnerability was generated by a series of historical factors, processes and decisions: the lagged effects of historical overcrowding; post-war regional policy including the socially-selective relocation of population to outside the city; more detrimental processes of urban change which impacted on living conditions; and differences in local government responses to UK government policy in the 1980s which both impacted in negative terms in Glasgow and also conferred protective effects on comparator cities. Further resulting protective factors were identified (e.g. greater 'social capital' in Liverpool) which placed Glasgow at a further relative disadvantage. Other contributory factors were highlighted, including the inadequate measurement of deprivation.

A similar 'explanatory model' resulted for Scotland as a whole. This included: the components of the Glasgow model, given their impact on nationally-measured outcomes; inadequate measurement of deprivation; the lagged effects of deprivation (in particular higher levels of overcrowding historically); and additional key vulnerabilities.

Conclusions

The work has helped to further understanding of the underlying causes of Glasgow's and Scotland's high levels of excess mortality. The implications for policy include the need to address three issues simultaneously: to protect against key exposures (e.g. poverty) which impact detrimentally across all parts of the UK; to address the *existing* consequences of Glasgow's and Scotland's vulnerability; and to mitigate against the effects of *future* vulnerabilities which are likely to emerge from policy responses to contemporary problems which fail sufficiently to consider and to prevent long-term, unintended social consequences.

Word count: 462

Introduction

The higher mortality in Scotland¹⁻³, and especially in its largest city, Glasgow⁴⁻⁷, are well documented. Much of this is explained by recent experiences of deindustrialisation, deprivation and poverty, the latter being root causes of poor health in all societies, not just Scotland^{4,8-12}. However, in addition, high levels of *excess* mortality – that is, higher mortality *over and above that* explained by differences in socioeconomic deprivation – have been observed for Scotland compared with England & Wales¹³⁻¹⁷, as well as for Glasgow compared with similar post-industrial UK cities such as Liverpool, Manchester and Belfast^{18,19}.

The scale of this excess is considerable. It accounts for approximately 5,000 additional deaths per year in Scotland¹⁷, and makes a substantial contribution to the other principal mortality ‘phenomena’ associated with Scotland in recent times: the lowest, and most slowly improving, life expectancy in Western Europe; the widest mortality inequalities in Western Europe; and the persistently high rates of mortality among those of younger working ages^{1,3,20-22}. After adjustment for differences in deprivation, premature mortality (<65 years) in Scotland is 20% higher than in England & Wales (10% higher for deaths at all ages)¹⁷; similarly, the excess for Glasgow compared with Liverpool, Manchester and Belfast has been shown to be approximately 30% for premature mortality, and around 15% for deaths at all ages^{18,19}.

The excess has been observed in all parts of Scotland compared with the rest of Great Britain, but is greatest in and around Glasgow and the post-industrial West Central Scotland (WCS) conurbation. Importantly, the size of the excess is increasing over time: in 1981, after adjustment for differences in area-based deprivation, all-cause mortality in Scotland was c. 4% higher than in England & Wales. Three decades later, the excess had more than doubled to 10% (20% for deaths under 65 years) – this is shown in Figure 1. There is clear evidence of a similar widening of the excess observed in Glasgow compared with Liverpool and Manchester since the mid to late 1970s¹⁸. The excess is seen among males and females, all adult age groups (but highest among those of working age) and across

all social classes (although for premature mortality, it is more pronounced in comparisons of the poorest populations). It is observed for a broad range of causes of death (for example, see Figure 2, showing the excess in Glasgow compared to Liverpool and Manchester for seven causes of death), although with important distinctions between excess premature mortality (particularly influenced by higher rates of death from alcohol, drugs and suicide) and excess mortality at all ages (driven particularly by higher numbers of deaths from cancer, heart disease and stroke). Given the relationship between socioeconomic factors and health behaviours, the excess persists even after statistical adjustment for differences in behaviours such as smoking, physical activity, diet et c.^{13,16-18,23-25}.

[Figure 1 about here]

[Figure 2 about here]

Many potential explanations have been proposed²⁶. The aim of the work reported here was to identify, by means of an in-depth assessment of all the available evidence relating to these explanations, the most likely causes of Scotland's and Glasgow's high levels of excess mortality. This is of potential relevance to many other countries, regions and cities where high levels of mortality have been observed.

Methods

Forty potential explanations for Scottish excess mortality were examined (Table 1). These were identified, first, by means of a systematic review of (a) all proposed explanations for Scottish excess mortality and (b) all proposed explanations for higher mortality between otherwise comparable high-income populations outside Scotland²⁶. The results of the review were cross-checked with a list, compiled by the authors over several years, of the many explanations for Scottish excess mortality which have been proposed, including those made via books²⁷, peer reviewed journals²⁸⁻³³, official government reports^{34,35}, invited commentaries³⁶, personal communications, and in discussion at

numerous events where evidence of Scottish excess mortality has been presented or discussed by the authors. As Table 1 shows, the hypotheses cover a great many, varied, topics including differences in climate (e.g. Vitamin D deficiency, higher rainfall), various health behaviours, income inequalities, migration, political influences, environmental factors and many more.

[Table 1 about here]

The validity of each individual hypothesis in terms of its association with mortality was assessed using the Bradford Hill criteria for causality³⁷. If a causal association was deemed plausible, relevant data were examined to ascertain whether there were differences in the exposure between Scotland and England & Wales, and/or between Glasgow and Liverpool/Manchester (the English cities having been shown previously to be excellent comparator cities^{18,23,25,38-40}). Web Table 1 summarises the individual assessments of the 40 hypotheses. The full assessments are available elsewhere¹.

As it was recognised that the purely individual assessment of each hypothesis would be reductionist, each hypothesis deemed potentially relevant was further assessed in terms of links to other key health exposures and risk factors, as well as to other hypotheses. A broadly 'dialectical' approach was employed, and a series of causal chains created, with the authors using logic and argument to decide whether the inclusion or exclusion of particular factors was likely to improve or weaken the 'fit' and explanatory power of the synthesised causal forces in relation to the associated outcomes (i.e. 'testing' the models to determine the extent to which the causal chains of factors could explain the different facets of excess mortality: as discussed in the introduction to this paper, these include higher mortality across all social classes but greater premature excess mortality among the poorest, a widening excess over recent decades, highest excess among those of working ages etc.). In this way, two initial explanatory models were created, one for Glasgow and one for Scotland. These were presented, and further refined, at a meeting in June 2015 in which over 30 key figures from public health and other relevant disciplines and professions participated¹. The models were again tested to assess whether (and to what extent) they were likely to explain all the main features of excess

mortality discussed above. The same ‘dialectical’ approach was used: in a combination of facilitated small groups and plenary discussion, the causal chains were constructed component by component, and participants were asked to assess, and where required, make amendments to the models. Similar ‘key informant’ participation was used to agree sets of policy recommendations in response to the presented models.

Both models were created in an identical manner. However, more evidence was available to support the Glasgow model, arguably reflecting a greater research focus on the city’s levels of excess mortality in recent years.

The conceptualisation of the models was based upon the known causal relationship between poverty, deprivation, deindustrialisation and health; and the known causes of the widening economic and health inequalities across the UK in recent decades⁴¹⁻⁴⁴. The focus of the models was to identify the factors (effect modifiers⁴⁵) which are likely to have brought about the relatively higher mortality in Scotland and Glasgow compared to other populations which were similarly exposed to these overall trends (Figure 3).

[Figure 3 about here]

Results

Explanatory model for excess mortality in Glasgow

The explanatory model developed for Glasgow is shown in Figure 4. Nine broad categories of explanation were identified: each is described briefly below.

1. Greater vulnerability

Key to the Glasgow model is that the city, over time, was made *more vulnerable* than the comparator cities to the particular socioeconomic and political exposures shown in Figure 3 (poverty, deprivation, widening income inequality), resulting in worse health outcomes. The concept

of vulnerability has been shown to be important in understanding differences in health between populations (and across different sections of populations) ⁴⁶⁻⁵¹. Vulnerability in the Scottish context was generated by a series of historical factors, processes and decisions described below.

2. Lagged effect of high historical levels of deprivation

Although analyses of historical *income* and *employment* based measures of deprivation show few differences between Glasgow, Liverpool and Manchester over many decades^{38,40}, compared with these English cities, Glasgow (alongside other Scottish areas) endured notably higher levels of overcrowding, from at least the middle of the 20th century^{40,52,53}. This represents both a marker of historical deprivation as well as a direct causal pathway to poor health from exposure to inadequate housing^{8,11,54-56}.

3. UK government Scottish Office regional economic policy 1950s-1970s

Scottish Office regional policy from the later 1950s involved a socially selective programme to relocate both industry and population away from Glasgow (officially designated as ‘declining’) to New Towns and other ‘growth areas’ across central Scotland. This was part of a wider regional ‘modernisation’ agenda focused on attracting lighter industries from outside Scotland. These other areas became the key priority in terms of both economic and social investment. New research has shown how this policy was pursued with conviction over the ensuing decades, despite increasing awareness of the negative consequences (both socioeconomic and demographic – and also ultimately health-related) for Glasgow⁵⁷.

4. Urban change 1950s-1980s

Related to 3 above, the nature and scale of post-war urban change experienced within Glasgow was different from the comparator cities. This is relevant to population health in terms of social determinants such as housing, living conditions and social and community networks. Glasgow differed in terms of: larger-scale slum clearances and demolitions (reflecting Glasgow’s greater

contemporary housing challenges, but also the associated impact on social support through disruption to existing communities); larger within-city (poor quality) and often peripheral council housing estates; greater emphasis on high-rise development (relevant because of the known links between high-rise living and negative impacts on mental health⁵⁸⁻⁶⁰); and also lower investment in housing repairs and maintenance of the public housing stock⁵².

5. Local government responses 1980s

Differences in local government responses to UK government policy after 1979 also had impacts. Research suggests that Glasgow's early prioritisation of inner-city gentrification and commercial development is likely to have exacerbated the damaging impacts of UK policy on what was already a vulnerable population. In the other cities, local government responses were more likely to have mitigated these damaging impacts, either by slowing them (Manchesterⁱ) or by mobilising local opposition against them (Liverpool). In the latter case, the city-level response fostered widespread participation and politicisation of the Liverpool public and, as a consequence, local government gave greater effective priority at an important stage to dealing with social issues (e.g. building new council housing and public amenities) than was the case in Glasgow⁶¹⁻⁷².

6. Other protective effects: social capital, ethnic diversity

A further protective factor (related to these historical processes of politicisation, participation and associated factors such as maintenance and strengthening of community ties) is higher levels of 'social capital' (or social fabric) in Liverpool as compared with Glasgow. This is seen, for example, in notably higher levels of neighbourhood trust, 'reciprocity' (e.g. looking out for, and after, friends and neighbours), volunteering (a component of social participation) and political participation compared

ⁱ As explained in the original report¹, local government in Manchester resisted co-operation with the UK Government until 1987 when, faced with the third consecutive Westminster electoral victory for the Conservative Party, it reversed its previous policy of non-co-operation to work with the Government to promote a neoliberal model of urban renewal and regeneration. In this way, Manchester was – at a key point in time – temporarily protected from the impact of the UK government's policy agenda, and other aspects of the latter were delayed for the greater part of the decade.

to Glasgow^{39,73}. These kinds of factors have been shown to be associated with population health outcomes (including all-cause mortality) in a large number of studies⁷⁴⁻⁸⁵.

More speculatively, the research suggests that other protective factors may be operating in Manchester, primarily in terms of the city having a greater level of ethnic diversity (and the healthy migrant effects with which that is likely to be associated⁸⁶⁻⁹²).

7. 'Democratic deficit' 1980s-1990s

Potentially exacerbating the effects of the UK government economic policies of the 1980s to mid-1990s was the negative impact of the so-called 'democratic deficit' experienced in Scotland during that period: the implementation of policies by UK governments which had been repeatedly (and increasingly) rejected by the Scottish electorate (including, in particular, constituencies in and around Glasgow). This perceived imposition of 'alien' policies on Scotland by a distant UK government led to feelings of despondency, disempowerment, and lack of sense of control (recognised 'psychosocial' risk factors with links to adverse health outcomes)⁹³⁻⁹⁶.

8. Inadequate measurement of poverty and deprivation

A further component of the model (acting directly rather than as an 'effect modifier') is a recognition of the inadequate measurement of poverty and deprivation: that is, that despite many different measures of deprivation and socioeconomic circumstances having been used in analyses of excess mortality to date, these measures fail to capture sufficiently differences in the complex, multi-dimensional, 'lived reality' of deprivation and poverty in Scotland, and especially in Glasgow, compared with elsewhere in Great Britain and the UK.

9. Other components

Other contributions were assessed as having arisen from a more negative physical environment (specifically, levels of vacant and derelict land) ^{97,98}, and small possible contributions from slightly lower educational attainment and some other factors¹.

[Figure 4 about here]

Explanatory model for excess mortality in Scotland

The explanatory model for Scotland as a whole is made up of various components, including:

- the model for Glasgow in its entirety, given the extent to which that impacts on the national level of excess mortality: with 11% of Scotland's population resident in the city, and more than 40% resident in its wider conurbation, population health in and around the city impacts considerably on national outcomes⁹⁹.
- elements of the Glasgow model which are highly, in some cases more, relevant to Scotland as a whole. These include: inadequate measurement of deprivation; the lagged effects of deprivation (in particular higher levels of overcrowding historically); and key vulnerabilities, including the so-called democratic deficit, as well as other aspects of Scottish Office regional economic policy in the post-war period which while having a detrimental effect on Glasgow, failed to deliver anticipated benefits elsewhere in the country^{57, 96-104}.
- Additional factors including a more profound experience of deindustrialisation compared with England & Wales⁴⁰, and some differences in (potentially culturally-influenced) 'downstream' health determinants such as diet (although the impact of the latter is small)¹⁰⁵.

Discussion

A detailed assessment of a huge amount of research evidence has resulted in the development of two 'explanatory models'. We argue that the various components of those models cumulatively contribute to the high levels of Scottish excess mortality.

To what extent do these models explain the main features of Scottish excess mortality in terms of higher mortality observed across all social classes and age groups, associated with a broad range of diverse causes of death, and increasing over time?

In terms of the high levels of excess premature mortality among *more deprived populations* (linked to high rates of death from, in particular, alcohol, drugs and suicide), the key components of the model are all relevant and provide an explanatory framework based on much of our existing knowledge of the determinants of health (i.e. in which socioeconomic factors, including the lagged effects of poverty and deprivation, play key roles). Thus, the effects of poverty and deprivation, other negative impacts of deindustrialisation (e.g. de-skilling, role redefinition), the psychosocial impacts of marginalisation and social exclusion – all factors which are common to many populations in a Britain that has been characterised by significantly widening inequality over the past 35 years – have been made worse in Glasgow (and Scotland) by pre-existing vulnerabilities (brought about by a series of historical factors), including a flawed model of 'economic modernisation', and other 'modifying' factors. This has led to a different experience of deprivation, weakened social relationships, relatively greater stress, worse mental and physical health, compensated for – in some cases – by greater reliance on alcohol and drugs related 'coping mechanisms', resulting in yet worse health outcomes^{106,107}. In the case of the cities, the position of Glasgow's more disadvantaged population has been made worse relative to Liverpool's in particular because the vulnerability of Glasgow has operated alongside a protective 'capacity' for Liverpool in terms of the latter's greater social fabric and cohesion.

Relatively higher mortality in Glasgow and Scotland among *those of higher social class* compared with the rest of Britain is best explained by the evidence of vulnerability – as the key ‘effect modifier’ in the models – affecting *all* social classes in society. This perspective reflects the work particularly of Galea and colleagues, who have shown vulnerabilities impact across whole communities, including on those within those communities not themselves specifically exhibiting the vulnerabilities which mark the population as a whole⁴⁷⁻⁵¹. In addition, the relative position of Glasgow’s middle classes has been made worse because some of the protective effects in the comparator cities relate particularly to those of higher socioeconomic status (SES): differences in some aspects of social capital between Liverpool and Glasgow (trust, reciprocity, volunteering) have been shown to be greatest in comparisons of those of higher SES^{39, 73}; and some qualitative research in three cities has suggested Manchester’s better cultural adaptation to being a post-industrial centre was most apparent among more affluent residents (albeit that this finding was based on a small study)¹⁰⁸.

The increasing nature of the excess is best explained by combinations of particular vulnerabilities having ‘held back’ the Scottish and Glasgow populations relative to other populations over time. These have occurred as ‘sweeps’, one following the other, arguably allowing no time for recovery. This is all reflected in slower rates of improvement in mortality compared with elsewhere in the UK^{1,3,18,23-25}. For the later period it links directly to a greater vulnerability to UK economic and social policies which, in combination with other factors, saw an increase (in absolute, not just relative, terms) in mortality among those aged 15-44 years over almost 20 years from the early 1980s (a key historical period in the models)³. As described elsewhere, this was driven by increases in mortality from alcohol, drugs, suicide and violence^{3,109,110}. Although this increase was not observed in most other Western European countries, it was observed in other regions of the UK such as Merseyside and the South Wales coalfields that were also exposed to the (closely interconnecting) factors of deindustrialisation, deprivation and UK economic policy; however, the rates and increases were generally not on the same scale as in Glasgow and West Central Scotland^{23,24}.

This also partly explains the excess being observed across all adult age groups, but being particularly high among those of working age. More generally, the ages most affected correspond with the timing of the key vulnerabilities highlighted. For example, higher levels of overcrowding have been evident for Scotland and Glasgow (compared with elsewhere in Britain) for most of the post-war period^{17,52}. The age profile of those born into, or already experiencing, difficult, overcrowded, conditions is consistent with the age profile of those contributing to the excess in later periods. For example, those born in 1951 would have been 40 years old by 1991 (when Scottish excess mortality was about 7% (10% for premature mortality)) and 60 years old by 2011 (by which point the excess was 10% for all ages and 20% for <65 years). The key historical periods associated with vulnerabilities in the models were in the period 1950s-1980s, and 1980s onwards. This is consistent with the age groups which contribute most to the excess.

Strengths and limitations

Strengths

There are a number of key strengths associated with this work. This includes the high number of hypotheses that were identified and assessed (including from a systematic review of all proposed explanations for differences in mortality between high income countries), and the amount of research undertaken for hypotheses for which evidence had previously been lacking. Core parts of the methodology, including the use of Bradford Hill criteria for causality, have ensured that an appropriately robust approach has been applied to the research. The ‘framing’ of the effect modifiers around the evidence-based notion of vulnerability added a highly useful dimension to the work. Finally, the testing, and subsequent modification, of the models with key informants from public health and a range of other relevant disciplines and professions, has resulted not only in improved explanatory models but also – and importantly – a broad consensus among key individuals regarding the most likely drivers of excess mortality¹. This itself, given the many years of debate around this issue, is a helpful step forward.

Limitations

The work also has a number of weaknesses. First, the assessment of some of the hypotheses continues to be hindered by a lack of robust evidence and data. A greater number of these ‘unknowns’ relates to comparisons of Scotland with England & Wales, meaning that there is less certainty around how far some of the important vulnerabilities highlighted in the Glasgow model also apply to areas that lie outside the West Central Scotland conurbation. Edinburgh, Aberdeen and Dundee are good examples, given both their geographical position and the high rates of excess mortality that have been observed in comparison with England & Wales. Exploration of local government responses in these cities in the key time periods highlighted in the models (1950s-1980s, and 1980s onwards) is one of a number of recommendations for further research which are listed in the full report¹.

Second, the inability to quantify the impact of each component of the model on the level of excess mortality may be seen as an important limitation. However, given the nature of the research, and the evidence and data upon which it was based, it was not possible to estimate such effectsⁱⁱ.

The use of the Bradford Hill criteria for causality has been criticised by some, with – for example – each criterion on its own deemed insufficient to prove causality⁴⁵ (and other commentators have since argued for a greater focus on the multifactorial aspects of disease development¹¹¹). Similarly, although we have proposed the use of the vulnerability ‘framework’ as a core strength of the work, the application (and development) of this theory to public health remains relatively recent, and work to develop and strengthen it is still ongoing.

ⁱⁱ A good example of this is the ‘democratic deficit’ in the 1980s and 1990s. As stated earlier, the evidence linking psychosocial risk factors with adverse health outcomes is well known. However, no studies have attempted to quantify the impact of this particular psycho-social exposure on Scottish mortality generally, but even if they had done so, it would still not be possible to estimate its relative contribution to levels of excess mortality when taken alongside the other components of the model (to which this same limitation clearly applies).

Despite all these issues, however, we would argue that the core strengths of this work substantially outweigh the weaknesses, and the accumulated evidence has helped provide a much improved insight into the likely causes of excess mortality in Scotland than has previously been available.

Generalising findings

There are important lessons from this research that extend well beyond Scotland. These include the potential importance of a vulnerability approach in relation to population health within a UK setting, a re-emphasis of the significance of the political economy and the importance for health outcomes of how this operates across different levels and scales (local, regional, national and international/global) and, of course, how this is tied to individuals' place of residence over the lifecourse. These and the other lessons that have emerged from the research are particularly important given the fact that evidence of this type of excess mortality has also been demonstrated outside Scotland e.g. in comparison of northern English cities and regions¹¹²⁻¹¹⁴.

Policy recommendations

The fuller report of this research lists a detailed set of policy recommendations in response to the research findings¹. These are based on an understanding that the important factors which emerge from this analysis – poverty and deprivation, deindustrialisation, and exacerbated inequality linked to current, past and future vulnerabilities – are inextricably entwined. Thus the recommendations emphasise the need to address three issues simultaneously: to protect against key exposures (e.g. poverty, deprivation) which impact detrimentally across the whole UK (but especially in places like Glasgow, Liverpool and Manchester); to address the existing consequences of Glasgow's and Scotland's vulnerability; and further, to mitigate against the effects of future vulnerabilities which are likely to emerge from policy responses to contemporary problems which fail sufficiently to consider and to prevent long-term, unintended social consequences. The full list of recommendations therefore include specific measures aimed at: Scottish Government economic

policy (e.g. relating to ownership of capital, income and corporate taxation, wealth and asset taxation, 'fair work' (including adequate wage levels), industrial policy, social security, addressing the cost of living, 'poverty-proofing' of policies); housing and the physical environment (e.g. expanding the social housing building programme, extending the Scottish Housing Quality Standard, targeting cold and damp housing and fuel poverty, strengthening the impact of the Place Standard for Scotland, improving greenspace access and quality in deprived areas); and actions for local government (e.g. a 'poverty proofing' approach to local government policy-making, and specific to Glasgow (and a number of other local authorities), consideration as to how to maximise the potential of the recent 'City Deals' investment to mitigate against the effects of vulnerability in the population).

Given the scale and increasing nature of excess mortality in Scotland, and the consensus now achieved in understanding its causes and most appropriate responses, it is imperative that national and local governments take responsibility to act upon these recommendations.

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DECLARATIONS

Competing interests: none declared.

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Ethical approval: not required.

Contributions: DW and GM originally conceived the study. The research questions and analysis plan were agreed by all authors. All the evidence was reviewed by DW and GM. Specific aspects of new research were undertaken by CC and MT. DW drafted the manuscript. All authors provided substantial critical input to improve the manuscript and all authors approved the final draft.

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